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(12) UK Patent Application (19) GB (11) 2 270 453 (13) A

(43) Date of A Publication 16.03.1994

(21) Application No 9219393.7

(22) Date of Filing 14.09.1992

(51) INT CL[5]
A01C 1/04 , A01G 31/02

(52) UK CL (Edition M)
A1E EAAA EAE EA1 EE5 EM1 EM9

(56) Documents Cited
GB 2191925 A GB 2101862 A GB 2064934 A
GB 1206231 A GB 0867498 A US 4309844 A
US 4173844 A US 3703786 A US 3516196 A

(58) Field of Search
UK CL (Edition L) A1E EAAA EAAB
INT CL[5] A01C

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(54) **Seeding system.**

(57) A seeding system e.g. for growing grass comprises a flexible sheet 2 of paper, light card, or woven, matted, extruded texture which sheet is perforated to provide a regular array of through holes 4 for the roots. The upper side of the sheet 2 is coated with a mixture of an adhesive and a hydrophilic, or water swellable polymer, and (grass) seed is uniformly distributed over the whole surface at a distribution rate in the range of from 10 to 15 seeds per square centimetre. The underside or seed side of the sheet 2 may be coated with a layer 8 of fertilizer. Details of polymers/adhesives are given (see particularly Table 1), and the fertilizer may be organic. Figure 2 shows a roll 10 of sheet material fed on an endless conveyor 12 through a watering station 14 and a series of growing chambers 18, 20, 26, 28 with lamps 22, 24, 27, 29 and sprinklers 30, 32 and heater 34. A cutter 36 cuts sheet into lengths discharged to bin (e.g. animal feed bin).

FIG. 1

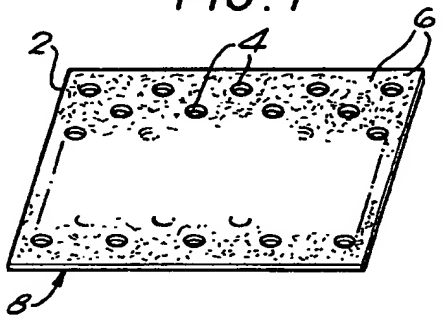
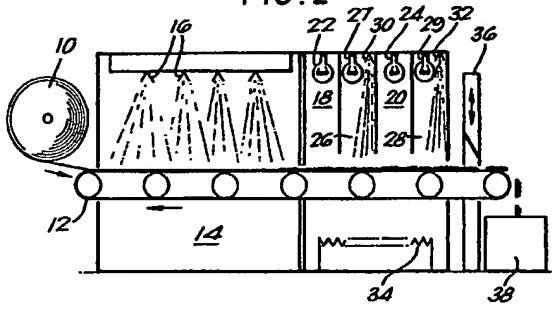


FIG. 2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

FIG. 1

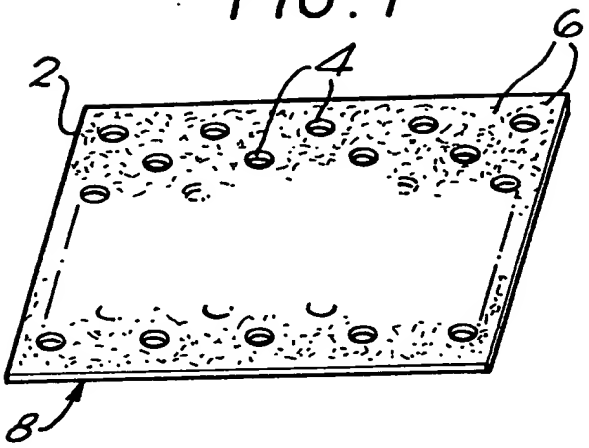
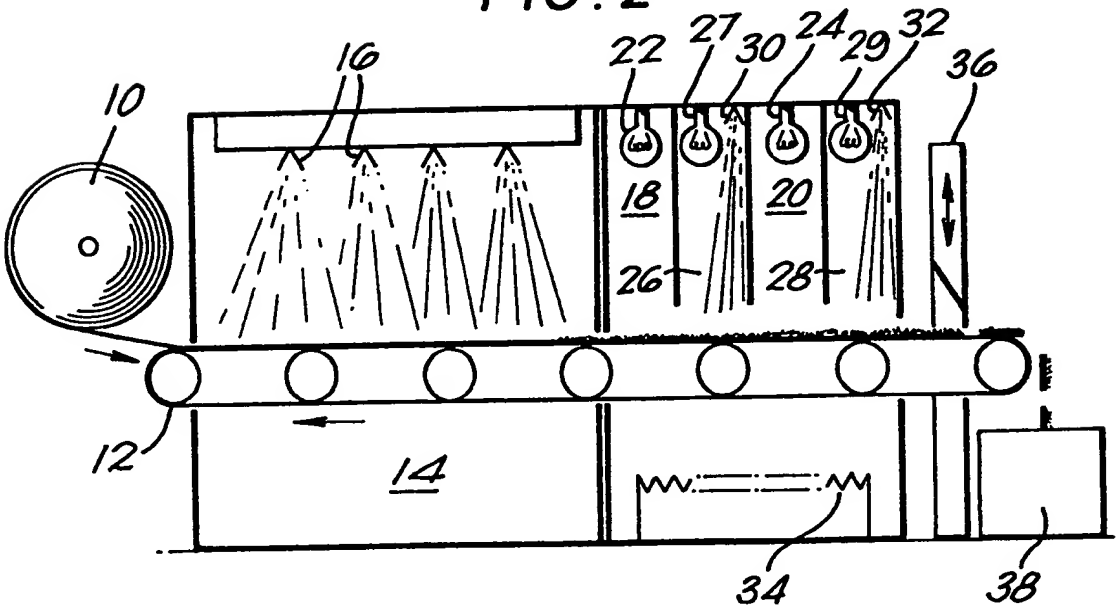


FIG. 2



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SEEDING SYSTEM

The present invention relates to seeding systems.

There have been proposed many examples of seeds being treated with polymers and other agents to enhance germination, to accelerate growth and to protect the seeds against pests and diseases.

In the case of grass it has been proposed to incorporate grass seed into tiles or boards made of materials such as wood, straw of peat (see UK Patent Specification NO 2 052 234). The tiles are then laid like a mosaic on a plot of land to be seeded and the mosaic is then watered.

The disadvantage of this system is that the tiles are generally inflexible and bulky, the basic medium of the tiles takes a long time to decompose, and developing roots are remote from underlying soil and hence growth is delayed.

It is an object of the invention to provide an improved seeding system.

According to the present invention there is provided a seeding system comprising a flexible perforated substrate, seeds distributed over one face of the substrate and adhesively secured to the substrate whereby when the seeds germinate their roots migrate towards, and extend through, the perforations into the underlying soil or compost.

Advantageously adjacent perforations in the substrate are spaced from one another by an edge to edge distance in the range of from 5 to 30 mm and occupy an area in the range of 0.5 to 25% of the overall area of the substrate. Preferably the spacing between edges of adjacent perforations is in the range of from 10 to 25 mm and the area of the substrate occupied by perforations is in the range of from 2 to 10%.

The thickness of the substrate may be in the

range of from 0.02 to 2.00 mm. The substrate is preferably card or paper but may be any similar two dimensional substrate of woven, matted or extruded texture.

The adhesive used to bond the seeds to the substrate is advantageously non-hygroscopic during storage under ambient conditions, but retains moisture when watered deliberately.

The adhesive may comprise a mixture of an aqueous emulsion of polyvinyl acetate and a hydroxypropyl cellulose. Preferably the ratio of polyvinyl acetate to hydroxypropyl cellulose is in the range of from 1:1 to 1:9 by volume.

The system may include a layer of fertiliser applied to the same or the opposite face of the substrate.

According to the present invention there is further provided manufacturing plant for processing a system as hereinbefore defined comprising means for supporting a roll of said substrate, a conveyer means for conveying said substrate from said roll through a watering station, and then a series of growing stations for subjecting said substrate to optimum growth conditions, and discharge means for discharging said substrate after said seeds have grown to a predetermined degree.

The plant includes heating and watering means for subjecting the seeds on said substrate to optimum growing conditions while passing through said stations.

The plant may includes cutter means for cutting said substrate into a predetermined sized pieces as it emerges from said stations.

A grass seeding system will now be described, by way of example, with reference to the accompanying diagrammatic drawing, in which:

Figure 1 is a plan view of the seeding system; and

Figure 2 is front elevation of a continuous process seed growing plant.

The seeding system to be described will be described specifically in connection with growing grass but it will be appreciated that the system can be used to grow other forms of vegetation such as clover for example.

As shown in Figure 1 the system comprises a flexible sheet 2 of paper or light card which has been perforated to provide a regular array of through holes 4. The upper side of the sheet 2 has been coated with a mixture of an adhesive and a hydrophilic, or water swellable polymer and grass seed has been subsequently scattered over the whole surface at a substantially uniform distribution rate in the range of from 10 to 15 seeds per square centimetre. The mixture has been allowed to dry to enable the seeds to adhere to the sheet 3. The underside of the sheet 2 had been coated with a layer 8 of fertilizer.

In operation the sheet 2 was placed on a layer of compost, covered with more compost to a level of substantially 2 mm, and thoroughly watered.

It was found that the hydrophilic polymer absorbed sufficient fluid to provide the seeds with a water reservoir to draw on during the subsequent initial growing period. As soon as the seeds started producing roots, the roots travelled along the surface of the sheet to the nearest hole or holes and then dived into the compost below. Subsequent watering of the sheet slowly leached the fertiliser out from the underside of the sheet to provide a continuous supply of nutrient to the emerging seedlings. After a relatively short period the sheet started to disintegrate to form part of the

compost. All trace of the paper sheet eventually disappeared.

The major problem of growing seeds on a sheet of paper or thin card is that the roots have difficulty penetrating the sheet or card and so the provision of an array of holes in the sheet or card provides ready access through the cards for the roots.

Advantageously the holes should collectively occupy an area in the range of 0.5 to 25% of the area of the card and preferably an area in the range of from 2 to 10%.

The spacing between the holes is advantageously such that the shortest distance between the edges of adjacent holes is at least 5 mm but preferably more than 10 mm and no more than 30 mm but preferably less than 25 mm. The thickness of the paper or card is advantageously in the range of from 0.1 mm to 2.00 mm.

In order to identify suitable adhesive and hydrophilic polymers the following experiments were performed.

EXPERIMENT 1 ADHESIVES/BINDERS

It was necessary to identify an adhesive which had the following properties:

- holds seeds firmly to the substrate, even when flexed or lightly rubbed.
- does not harm seeds fertility
- on watering would swell, would retain moisture, would not release the seed, but would not be hygroscopic on storage.

The following adhesives or polymers were coated on a 'blotter' card and, while still wet, seeds at a rate of 10 to 15 seeds per square centimetre were scattered evenly upon it. After drying, each card was placed on a layer of compost, covered with about 2 mm, of compost, watered, and the rate of germination and growth observed.

Results are given in table I.

TABLE I

SAMPLE	POLYMER/ADHESIVE *Trade Mark	MANUFACTURER	GENERAL OBSERVATIONS	YIELD OF GRASS (BLADES/ SEED SOWN)	HEIGHT (CM) AFTER 20 DAYS AT ROOM TEMPERATURE
1	A fatty alcohol and ethylene oxide mixture *Lutensol AT80	BASF	Poor coating	0.1 - 0.2	2.5
2	A poly (methylvinyl ether/ maleic anhydride) copolymer *Gantrez AN139	GAF	Poor adhesion	---	---
3	An aqueous emulsion of polyvinyl acetate *Unibond	Unibond Ltd	Good adhesion	0.3	3.5
4	An aqueous dispersion of a copolymer of acrylate and styrene *Acronal 290D	BASF	Good adhesion	0.3	2.7
5	A propylene oxide/ethylene oxide block polymer (50% ethylene oxide) *Pluronic PE10500	BASF	Good adhesion	0.3	3.0
6	A hydroxypropyl cellulose *Klucel L	Hercules	No adhesion	---	---
7	A hydroxyethyl cellulose *Natrosol 250	Aqualon	Mod/Poor adhesion	0.3	3.5 - 4.0
8	A natural rubber latex emulsion in ammonia *Copydex	Henkel	Good adhesion	0.5	3.5
9	An aqueous emulsion of polyvinyl alcohol *Woodfix	Copydex plc	Good adhesion	0.5	3.5
10	Control (scatter sown)			0.3	3.5 - 4.0

It was apparent that the samples 3,7, 8 and 9 gave germination and growth comparable to the control sample 10. However the binders for samples 3, 8 and 9 were just adhesives. It was hoped to find a swellable binder, such as used for sample 7, which would retain water longer. The adhesion of binder 7 was however not good. It was possible that a combination of adhesive and hydrophilic polymer would be acceptable.

1 Seed throughout was Johnson 'Quick Lawn' (trade mark), a ryegrass

2 Compost throughout was Arthur Bowers 'No.1' (trade mark).

EXPERIMENT 2 WATER ABSORPTION

Preliminary experiments showed that the binders from samples 3 and 7 of the previous experiment could be homogeneously mixed, and would provide good adhesion of seed to card with 10% or more of Unibond (sample 3) present.

In an attempt to combine the best properties of sample 3 and 7 in the above experiment, a series of mixtures were made:

5% Natrosol solution in varying ratios with Unibond, was coated onto glass, to a wet thickness of about 0.2 mm. After drying, one drop of water was placed on each coated area. As a measure of moisture absorption; after a quarter of an hour the angle x, to which the glass plate need to be tilted before the remainder of the water drop ran off, was measured. As a measure of time of water retention within a coating; the time t for a drop to evaporate to leave a level surface was recorded. All measurements were made in duplicate, under ambient conditions, and minimum drafts. The results are summarised in Table II.

Table II

% of 5% Natrosol solution mixed with % Unibond	100 0	67 33	50 50	33 67	0 100
slope of plate x degrees evap. time t hours	90(vert.) 6	60-70 6	45 7	30 5	30 5

It appeared therefore that a) Unibond alone dried out somewhat more rapidly than a 50/50, or higher, ratio mixture with Natrosol (5 hours to dryness compared with 6 to 7 hours); and b) the higher the amount of Natrosol the larger the amount of water absorbed initially (90 degrees for 100% Natrosol solution decreasing to 30 degrees for 100% Unibond). The optimum ratio of Natrosol and Unibond to provide good adhesion of seed to card, to provide good water uptake, and to provide good water retention appeared to be in the range of from 90:10 to 50:50.

EXPERIMENT 3 ROOT GROWTH

Trial growths of seed on a range of card types had shown that the root system invariably moved to the edge of the card before growing down into the compost. This slowed the growth rate. To overcome this difficulty a coating was made in which a series of 8 mm holes were punched, in hexagonal array, at 2.8 cm nearest centres. This was placed on coarse sand, covered with about 2 mm of sand, and watered at 2 day intervals. It was compared with an identical coating without holes, and also with a control area sown broadcast at the same seed laydown of 8 to 10 seeds per cm, and also covered with sand. The results are summarised in Table III.

Table III

	Without holes	Broadcast control	With holes
First shoots after (days)	5	5	5
Height in cm after 10 d.	6	6	7
No. shoots per cm sq (10d.)	3	2	5
Height in cm after 15 d.	7	7	8
No. shoots per cm sq (15d.)	3	2	7
Appearance of root system after 16 days	No roots through card - roots round edge	Good root system	Good root system - many through holes

It appeared therefore that the insertion of holes in the coating increased the number of shoots per centimetre and produced taller blades of grass compared with a sample coating without holes and compared with control hand-sown areas.

EXPERIMENT 4 FERTILISER

To improve fertility of the coatings a fertiliser was incorporated as follows: A standard coating was provided on a card. The coating was in the form of a binder of 5% Natrosol solution plus Unibond in ratio of 2:1 with seed at rate of about 8 seeds/cm scattered on while wet, and then perforated when dry. On the reverse side of the standard coated card, a second coating of polymer/adhesive was made on one half and, while still wet a fertiliser powder at a rate of about 0.05g/cm sq was sprinkled on; the other half of the reverse was left clear. After complete drying the two halves of the coating were separated and laid on coarse sand (to eliminate any fertilising effects of a compost), covered

with approximately 2 mm of sand and watered at 1 to 2 day intervals. A broadcast control at about 8 seeds per cm sq was also included. The results are summarised in table IV.

Table IV

	No fert. ctg.	Broadcast control	With fert. ctg.
Height shoots after 10d (cm)	2 to 3	2 to 3	2 to 3
Number shoots/cm sq (10d)	4	4	4
Ht after 14d (cm)	5	6	6
Ht after 25d (cm)	6	7	8

It appeared therefore that the inclusion of fertiliser in the coating produced, after 25 days in this infertile medium, an increase in blade height, compared to a no fertiliser control coating and compared to a hand sown area. The colour of the grass was also greener than that in the 'no fertilizer' areas.

The fertiliser used was an organic plant food in the form of a mixture of chicken manure and an organic filler (eg peat, straw, wood chips) with its pH adjusted to about 6.0. The mixture was sterilised and then extruded to form crumbs or pellets.

In a modification the fertiliser can be coated on the same side of the sheet as that to which the seeds are applied.

The method of growing grass seed by means of the above described system has many advantages over the traditional method of scattering seed over a given area by hand.

This system ensures the correct application or lay down rate for the seeds and so obviates the need to calculate the weight required for a given area and the metering rate during distribution. The system allows

seeds to be readily distributed on steep slopes without the attendant problem of the sown seed migrating to the bottom of the slope.

The provision of built-in fertiliser enables grass to be grown on relatively infertile areas. The adhesive builder makes it more difficult for birds and other wildlife to feed on the seeds.

The sheet can be formed in a roll for easy storage and carriage and the system allows the grass to be laid by relatively unskilled persons - the sheet merely needs to be cut to size to cover the area required, to be anchored by a layer of sand or compost or by anchoring pins and to be watered.

The germination and growth of the seeds has been found to be superior to other methods of growing grass.

As already indicated the system can be used to grow products other than grass.

While the perforated sheet is in the form of card it will be appreciated that the sheet can be of woven or matted or extruded material of fibre glass, of nylon (trade mark) or of polypropylene - depending upon the properties required eg hard wearing or biodegradable.

The sheet may carry advertising or other messages printed on one or both sides of the sheet.

When required the sheet may carry additional agents such as degraders, fertility enhancers and bird/pest repellants.

The plant shown in Figure 2 is arranged to produce a continuous output of cattle, or other livestock fodder.

As shown a roll 10 of sheet material carrying grass seed adhesively secured thereto as hereinbefore described, is fed through a machine on an endless conveyor 12. The conveyor 12 carries the sheet 10 through a watering station 14 where sprinklers 16 apply a

fine mist of water to soak the material 10. The material then passes through a series of growing chambers. Each chamber 18, 20, 26 and 28 is provided with respective lamps 22, 24, 27 and 29 which simulate daylight. Each chamber 26 and 28 is also provided with a respective sprinkler 30 and 32 to keep the sheet moist. All chambers are heated by a heater 34. As the sheet emerges from the machine after some 5 to 10 days processing, substantial growth will have been achieved and a cutter 36 acts periodically to cut the sheet into short lengths. The short lengths are then discharged into a holding bin 38 (which can be an animal feed bin).

In this way the growth of fodder for live stock can be fully mechanised.

CLAIMS

1. A seeding system comprising a flexible perforated substrate, seeds distributed over one face of the substrate and adhesively secured to the substrate whereby when the seeds germinate their roots migrate towards, and extend through, the perforations into the underlying soil or compost.

2. A seeding system according to Claim 1, wherein adjacent perforations in the substrate are spaced from one another by an edge to edge distance in the range of from 5 to 30 mm and occupy an area in the range of 0.5 to 25% of the overall area of the substrate.

3. A system according to Claim 1, wherein the spacing between edges of adjacent perforations is in the range of from 10 to 25 mm and the area of the substrate occupied by perforations is in the range of from 2 to 10%.

4. A system according to any one of Claims 1 to 3, wherein the thickness of the substrate is in the range of from 0.02 to 2.00 mm

5. A system according to any preceding claim, wherein the substrate is of paper or card.

6. A system according to any one of Claims 1 to 4, wherein the substrate is a two dimensional substrate of woven, matted or extruded texture.

7. A system according to any preceding claim, wherein the adhesive used to bond the seeds to the substrate is non-hygroscopic during storage under ambient conditions, but retains moisture when watered deliberately.

8. A system according to any preceding claim, wherein the adhesive comprises a mixture of an aqueous emulsion of polyvinyl acetate and a hydroxypropyl cellulose.

9. A system according to Claim 8, wherein the ratio

of polyvinyl acetate to hydroxypropyl cellulose is in the range of from 1:1 to 1:9 by volume.

10. A system according to any preceding claim including a layer of fertiliser applied to the same or the opposite face of the substrate.

11. Manufacturing plant for processing a system according to any preceding claim comprising means for supporting a roll of said substrate, a conveyor means for conveying said substrate from said roll through a watering station, and then a series of growing stations for subjecting said substrate to optimum growth conditions, and discharge means for discharging said substrate after said seeds have grown to a predetermined degree.

12. Plant according to Claim 11 including heating and watering means for subjecting the seeds on said substrate to optimum growing conditions while passing through said stations.

13. Plant according to Claim 11 or to Claim 12 including cutter means for cutting said substrate into predetermined sized pieces as it emerges from said stations.

14. A grass seeding system substantially as hereinbefore described, with reference to the accompanying drawing.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9219393.7

Relevant Technical fields

(i) UK Cl (Edition L) A1E (EAAA, EAAB)

(ii) Int Cl (Edition 5) A01C

Search Examiner

J M WORVELL

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

23 SEPTEMBER 1993

Documents considered relevant following a search in respect of claims 1-14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2191925 A (OGILVY)	1, 4, 5 at least
X	GB 2101862 A (BRITTON)	1, 6 at least
X	GB 2064934 A (SCAGGS) See eg. Claims 5, 6	1, 5 at least
X	GB 1206231 (VON WALDENFELJ)	1 at least
X	GB 0867498 (POLYCELL)	1, 5, 10
X	US 4309844 (KING ET AL)	1
X	US 4173844 (KNOLLE ET AL)	1, 5 at least
X	US 3703786 (SWAN)	1, 2, 3 at least
X	US 3516196 (LIPPOLDT)	1, 5 at least

	Identity of document and relevant passages	Relevant to claim(s)

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